Remarks:

Applicants have read and considered the Office Action dated March 6, 2008 and the references cited therein. Claims 1, 3, 8-11, 18, 21, 25, 27, 30, 35, 37, 41-47, 52, and 54 have been amended. Claims 15, 16, 26, 29, 36 49, and 53 have been cancelled without prejudice or disclaimer. New claims 59 and 60 have been added. Claims 1-14, 17-25, 27, 28, 30-35, 37-48, 50-52 and 54-60 are currently pending. Reconsideration is hereby requested.

Independent Claims 1, 21 and 37:

Claim 1 is directed to a hearing aid device for enhancing the hearing of speech. The hearing aid includes an electro-acoustic transducer (e.g., a speaker) and a compensatory signal generator (for example, a processor coupled with a storage unit). The compensatory signal generator determines a compensatory signal and provides it to the electro-acoustic transducer, which produces sounds in the vicinity of an ear of a user. The compensatory signal generator determines the compensatory signal according to speech sounds, such that the compensatory signal induces stochastic resonance with the speech shaped sounds of the ambient sound.

The concept of Stochastic Resonance (SR) describes systems with both periodic (coherent) and random forcing. When an energetic barrier (i.e., essentially a threshold) limits the propagation of the signal, an increase in random (i.e., stochastic) noise results in an improvement in the Signal-to-Noise Ratio (SNR) of the coherent signal. Thus, a cooperative phenomenon between a weak periodic signal (the coherent target signal) and other random fluctuations (i.e., stochastic noise) will create a much stronger periodicity. It is noted that stochastic resonance is not strictly a resonance in the sense of an increased response when a driving frequency is tuned to a "natural frequency" of the system. The analogy to resonance is still useful in that the SNR (the "response") is maximized when some parameter, in this case the input noise, is tuned near a certain value.

Stochastic resonance requires three conditions to be fulfilled in order to occur:

1. An energetic activation barrier (i.e., a form of threshold);

2. A weak coherent input signal (i.e., a periodic signal);

3. A source of noise that is inherent in the system or that is added to the coherent input.

When these conditions are met, the SNR of the target signal is improved and demonstrates non-linear amplification (i.e., the amplified signal is not distorted in comparison to the original signal).

Applying the SR transformation to an input signal allows the brain to classify unrecognized signals, build a matched filter around the specific frequencies of a recognized target signal, and store filter templates for pre-recognized signals (e.g. the voice of people we know). It is further noted that, these stored filter templates offer a very compact form of recognition storage, a few data points that describe typical frequencies of the target signal and their associated power spectrum suffices.

The stochastic resonance applied by the hearing aid of the disclosed technique improves the signal to noise ratio of speech sounds. In other words, the device of Claim 1 is not based on amplifying the speech sounds, rather the device is based on applying stochastic resonance (i.e., at the speech spectrum) for improving the signal to noise ratio, and thus improving the hearing of speech shaped sounds. This is fundamentally different than the cited prior art.

Claims 1-5, 15, 16, 18, 21-34, 36, 37, 39, 40, 42, 44, 48, 49, 52, 53 and 56 were rejected under 35 U.S.C. § as being anticipated by Rembrand. Rembrand describes a hearing aid, including a noise generator, an ear phone, a microphone, a mixer, a noise gate and an amplifier. The noise generator forwards temple noise (e.g., a recording of otoacoustic emissions) to the mixer. The microphone detects ambient sound and forwards it to the mixer. The mixer mixes the temple noise and the ambient sound, and provides the mixed signal to the noise gate. The noise gate filters signals, which have an amplitude below a certain threshold, and passes signals, which have an amplitude exceeding that threshold. The amplifier amplifies the signal and provides it to the earphone. Rembrand teaches away from the claimed subject matter by stating that the amount of filtering and amplification is proportional to the speed of blood rushing in the temple. As discussed above, this is fundamentally different from the present system.

Claim 1 is directed to a hearing aid device producing a compensatory signal according to speech sounds, for improving the hearing of speech shaped sounds and not at simply amplifying sound and attempting to improve hearing over the entire hearing spectrum.

Rembrand describes a hearing aid device that mixes temple noise (e.g., otoacoustic emissions) with an ambient sound signal, for filtering and amplifying the ambient sound signal ("*it uses the natural or synthetic temple noise as the filtering and amplification aid*" See Page 1, Par. 5). Rembrand does not disclose nor suggest employing a specific portion of the otoacoustic emissions spectrum, which corresponds to speech sounds (e.g., distortion product otoacoustic emissions), as a compensatory signal for improving speech sounds. Additionally, Rembrand does not disclose employing speech sound that is not an otoacoustic emissions pattern as a compensatory signal. Therefore, Rembrand does not disclose or even suggest producing a compensatory signal according to compensatory waveform determined according to speech sounds, for improving the hearing of speech sounds. Moreover, Rembrand determines that no filtering frequency has to be applied (See Page 3, Par.3), thereby teaching away from the system now recited in claim 1, which is directed to speech sounds spectrum.

Moreover, claim 1 is directed to a hearing aid device for producing a compensatory signal in the frequency spectrum of speech sounds for applying stochastic resonance and thereby improving the hearing of speech sounds. Rembrand describes a hearing aid device including an amplifier for amplifying mixed signals (i.e., mixed ambient sound with temple noise). Rembrand does not disclose nor even suggest applying stochastic resonance for improving the hearing of sounds by the user without actually amplifying the signal. Claim 1 now recites a system that is fundamentally different from Rembrand and is non-obvious in view of Rembrand.

Claims 6 and 51 were rejected under 35 U.S.C. § 102(b) as being anticipated by Rembrand in view of the Mackie 1202 VLZ Pro Mixer Owner's Manual. Applicants assert that the independent claims patentably distinguish over Rembrand for at least the reasons discussed above. Applicants further assert that Mackie fails to remedy the shortcomings of Rembrand. Therefore, Applicants assert that the claims patentably distinguish over the combination of Rembrand and Mackie or any other prior art. Applicants therefore request that the rejection of claims 6 and 51 under 35 U.S.C. § 102(b) be withdrawn.

Claims 1, 20, 21 and 35 were rejected under 35 U.S.C. § 102(b) as being anticipated by Kandel et al. Kandel describes an audio device with signal processing capabilities for amplifying selected voice frequency bands, for the purpose of increasing speech intelligibility of persons with a sensory neural hearing disorder. Kandel describes a system that employs differential amplification of different formants (i.e., distinguishing frequency components of the acoustic frequency spectrum of human speech – usually, the first two formants are sufficient to disambiguate a vowel). The "second" formant frequencies are amplified, in order to "equalize the loudness" of the "first" and "second" speech formant frequencies, for the purpose of creating a more "normal loudness" relationship between the "first" and "second" speech formants. It is this compensation, according to Kandel, that greatly enhances the intelligibility for speech signals.

Conversely, claim 1 is directed to a hearing aid that produces a compensatory signal that applies stochastic resonance along with the speech sounds to be better heard. Claim 1 does not necessarily employ an amplifier and therefore does not actually amplify speech sounds. Kandel differentially amplifies different frequency bands (i.e., first speech formant frequency band and second speech formant frequency band) for restoring the normal loudness relationship between those different frequency bands, thus improving the intelligibility of speech. Kandel does not disclose nor does he suggest producing a compensatory signal for applying stochastic resonance.

Claim 1 is directed to a hearing aid device that produces a compensatory signal, determined according to speech sounds rather than producing negative feedback. The compensatory signal applies stochastic resonance within the frequency spectrum of speech sounds, and thus improves the hearing of speech sounds. Kandel records the differentially amplified audio signal (i.e., sound signals which are detected by the main microphone) as well as otoacoustic emissions produced by the ear of the user, for transmitting a negative feedback from the ear of the user to the mixer. The negative feedback stabilizes the signal processing circuit of Kandel and prevents regenerative oscillations of the amplified audio signals. Kandel does not disclose nor does he suggest producing a compensatory signal for applying stochastic resonance. The system of claim 1 is fundamentally dissimilar than the system of Kandel for several basic differences. Applicants assert that claim 1 patentably distinguishes over the prior art and request that the rejections be withdrawn.

Claims 43, 45, 46, 47 and 50 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Rembrand. As discussed above, claim 37 patentably distinguishes over Rembrand and is also non-obvious in view of Rembrand as discussed above. Claims 43, 45, 46, 47 and 50 are also believed to patentably distinguish over Rembrand for at least the same reasons as well as others. Applicants therefore request that the rejection of claim 43, 45, 46, 47 and 50 be withdrawn.

Claims 19, 54 and 55 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Rembrand in view of Bauer. Applicants assert that Bauer fails to overcome the shortcomings of Rembrand. Therefore, Applicants assert that claims 1 and 37 patentably distinguish over the combination of Rembrand and Bauer. Claims 19, 54 and 55 are also believed to be allowable for at least the same reasons as well as others. Applicants therefore request that the rejection of claims 19, 54 and 55 under 35 U.S.C. § 103(a) be withdrawn.

Claims 7-12, 38 and 41 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Rembrand in view of Stockham, Jr., et al. and Anderson. Applicants assert that the independent claims patentably distinguish over Rembrand for at least the reasons discussed above. Moreover, the combination of Stockham, Jr. and Anderson fail to address the shortcomings of Rembrand. Applicants therefore assert that the independent claims patentably distinguish over the combination of Rembrand, Stockham, Jr. and Anderson. As the independent claims patentably distinguish over the combination, Applicants assert that claims 7-12, 38 and 41 also patentably distinguish over the combination of Rembrand, Stockham, Jr. and Anderson. Applicants therefore request that the rejection of claims 7-12, 38 and 41 under 35 U.S.C. § 103(a) be withdrawn.

Claims 14 and 57 were rejected as being unpatentable over Rembrand in view of Stockham, Jr., Anderson and Sandlin. Applicants assert that claims 1 and 37 patentably distinguish over Rembrand and that the combination of Stockham, Jr., Anderson, and Sandlin when combined with Rembrand, fail to render claims 1 and 37 obvious. Stockham, Jr., Anderson and Sandlin fail to address the shortcomings of Rembrand. Applicants therefore assert that claims 1 and 37 are allowable for at least the reasons discussed above and that claims 14 and 57 are also allowable for at least the same reasons as well as others. Applicants request that the rejection of claims 14 and 57 under 35 U.S.C. § 103(a) be withdrawn.

Claims 13, 17 and 58 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicants thank the Examiner for the indication of allowable subject matter.

Claims 59 and 60 have been added and further clarify the energy of the compensatory signal as compared to thresholds. Applicants assert that the recited energy provides for improved performance while avoiding the problems associated with energy consumption and amplification found in the prior art. This is not shown or suggested by the prior art. Applicants assert that new claims 59 and 60 are therefore allowable.

A speedy and favorable action in the form of a Notice of Allowance is hereby solicited. If the Examiner feels that a telephone interview may be helpful in this matter, please contact Applicant's representative at (612) 336-4728.

Please consider this a PETITION FOR EXTENSION OF TIME for a sufficient number of months to enter these papers or any future reply, if appropriate. Please charge any additional fees or credit overpayment to Deposit Account No. 13-2725.

23552
PATENT TRADEMARK

Respectfully submitted,

MERCHANT & GOULD P.C.

Dated: 3/5/09

By: _____
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